ASTROPHYSICS SOFTWARE AND RESEARCH AIDS

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Under the Development of Astronomical Software Environments project, we carried out strategic planning for the long-term evolution of the *IRAF* analysis system. Our group, called the *IRAF* Technical Working Group (*ITWG*), explored ways to extend and evolve *IRAF* over the next decade, so as to exploit industry advances in technology while preserving the large and growing body of *IRAF* applications code.

The work of the *ITWG* was divided into two distinct but complementary areas:

- The *ITWG* met periodically to guide the ongoing development of *IRAF*. This group had a direct impact on the *IRAF* development schedule. It discussed current development plans, problems, requirements, *etc.* and formulated solutions and schedules to meet the needs of *IRAF* users.
- The *ITWG* investigated long-term strategies for the development of *IRAF* and performed research (in the form of prototypes) involving new technologies and new ideas or approaches.

Throughout the course of this grant, the *ITWG* met twice yearly to plan the development of new parts of the core *IRAF* system that were required for the further development of *IRAF* analysis software by the astronomical community. Projects that we brought to completion include:

- Extended development of the X-ray QPOE I/O interface, especially in the area of photon filtering
- Further development of the PLIO pixel mask interface, in order to be able to use these masks as full *IRAF* images
- Development of World Coordinate System support in order to incorporate the WCS more fully into analysis tasks

These and other projects were discussed and scheduled by the *ITWG* and then developed by NOAO in a timely manner to coincide with the scheduled updates of projects such as PROS and STSDAS. In this way, the development of *IRAF* over the past several years has been guided by the *ITWG*, based on the needs of the astronomical community. We consider it a major success of the *ITWG* to have forged the strong institutional and personal contacts that make these coordinated efforts possible.

In parallel with its role as a technical guide for current *IRAF* development, the *ITWG* worked on several prototypes in order to study and plan for the long-term development of *IRAF*. The major prototype efforts included:

- Development of line-edit capabilities for the *IRAF* command language (cl)
- Development of C-language bindings to *IRAF* VOS routines, so that *IRAF* tasks can be written in the C language

- Development of a host interface to *IRAF* VOS routines, so that host programs can access *IRAF* data structures
- Development of X-based graphical user interfaces for *IRAF*
- Experimentation with the porting of *IRAF* using a publicly available Fortran-to-C translator
- Development of a static code checker for SPP programs
- Development of techniques to produce sophisticated documentation using encapsulated postscript (EPS)
- Work on the *IRAF* image display interface project to provide enhanced image display and analysis capabilities within *IRAF*

Although these research project were not meant to produce production grade software, several of them have led to significant new software for the astronomical community, including:

- The ASSIST graphical user interface to *IRAF* and other analysis environments unifies heterogeneous software and information under a single GUI. ASSIST is based on the Answer Garden Substrate, a system designed to help groups organize and access databases of frequently asked questions and other information. The ASSIST provides a convenient way to traverse the *IRAF* package hierarchy, loading selected packages, access often-used tasks directly without traversing the package tree, inspect and change task parameters, run tasks, view task and package help files, *etc.* It has been used by projects such as GRO, AXAF, and the ground-based SUBARU telescope.
- The development of the *IRAF* widget server and the xgterm-image widget brings sophisticated graphics capabilities to *IRAF* tasks. This new software is being used by all major *IRAF* developers and also is being used in Unix programs such as the new version of SAOimage.
- The continued development of *OpenIRAF* brings the power of *IRAF* tasks and libraries to the Unix environment. The development of robust C bindings to *IRAF* routines and the development of methods to run *IRAF* tasks in the Unix shell are just two parts of the overall strategy for *OpenIRAF* that are the result of our prototyping activities.

These software developments all represent major developments in the evolution of astronomical software in general and the *IRAF* system in particular.

In 1992, NASA extended this grant in order to provide funding for the PI to organize two user interface workshops as follow-ups to the successful UI workshop held in April, 1992. The second workshop on "User Interfaces for Astrophysical Software", was held at GSFC on

August 24–25, 1993 and the third was held at GSFC on June 9–10, 1994. The workshops were attended by more than 40 persons from more than a dozen projects. They concentrated on the idea of cooperation between groups on user interface issues.